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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/388,989	09/02/1999	BARNEY M. COHEN	AMAT/3191.03	4766
32588	7590	10/22/2003	EXAMINER	
APPLIED MATERIALS, INC. 2881 SCOTT BLVD. M/S 2061 SANTA CLARA, CA 95050			PADGETT, MARIANNE L	
			ART UNIT	PAPER NUMBER
			1762	

DATE MAILED: 10/22/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/388,989

Applicant(s)

Cohen et al

Examiner

M.L. Padgett

Group Art Unit

1762

— The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address —

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

☒ Responsive to communication(s) filed on 7/7/03 and 4/8/03

☒ This action is **FINAL**.

- ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 1, 3-4, 6, 8-14, 17-23 + 33 is/are pending in the application.

Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.

☐ Claim(s) \_\_\_\_\_ is/are allowed.

☒ Claim(s) 1, 3-4, 6, 8-14, 17-23 + 33 is/are rejected.

☐ Claim(s) \_\_\_\_\_ is/are objected to.

☐ Claim(s) \_\_\_\_\_ are subject to restriction or election requirement

Application Papers

- ☐ The proposed drawing correction, filed on \_\_\_\_\_ is ☐ approved ☐ disapproved.
- ☐ The drawing(s) filed on \_\_\_\_\_ is/are objected to by the Examiner
- ☐ The specification is objected to by the Examiner.
- ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

- ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119 (a)-(d).

☐ All ☐ Some\* ☐ None of the:

☐ Certified copies of the priority documents have been received.

☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.

☐ Copies of the certified copies of the priority documents have been received

in this national stage application from the International Bureau (PCT Rule 17.2(a))

\*Certified copies not received: \_\_\_\_\_

Attachment(s)

- ☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). \_\_\_\_\_
- ☐ Interview Summary, PTO-413
- ☐ Notice of Reference(s) Cited, PTO-892
- ☐ Notice of Informal Patent Application, PTO-152
- ☐ Notice of Draftsperson's Patent Drawing Review, PTO-948
- ☐ Other \_\_\_\_\_

Office Action Summary

Art Unit: 1762

1. The translation of JP 56-155,526 to Yamazaki (JP reference supplied by applicant in IDS of 4/8/03, paper #25) has been received by the examiner, and is supplied to applicant with this action. As Yamazaki et al explicitly teach cleaning insulating substrates with H<sub>2</sub> + He plasma before metal deposition, it is in some aspects superior to Zhao et al, but as He or Ar may be used alternatively, it is also cumulative thereto, therefore this case is being reopened to apply this reference. Note, as applicant supplied this reference after final, it is proper for this to be a final rejection.

All amendments supplied after final, which were indicated that they would be entered in the case of an appeal, i.e. amendment D of 3/4/03 and amendment E of 4/23/03, were entered.

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary.

Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1, 3-4, 6, 8-14, 17-23 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yoo et al (5,203,957), in view of Zhao et al (5,660,682) and/or Yamazaki (JP56-155,526).

Art Unit: 1762

Discussion Yoo et al, Zhao et al, and the combination thereof may be found in section 5 of paper #20 (mailed 11/29/02). As noted previously, while Yoo et al teach a 2 plasma sequence, which may be considered to include cleaning, with the first plasma being an Ar plasma, the second plasma using He + a reactive gas, that is exemplified by reducing gases such as  $\text{CF}_4$  or  $\text{CF}_3\text{H}$ , but while it may include a H-containing gas serving like functions, Yoo et al differs from applicant's claims by not consisting essentially of  $\text{H}_2 + \text{He}$ , or comprising 5% H and 95% He.

While the English abstract of Yamazaki teaches cleaning a semiconductor substitute with an insulating surface, with a plasma of hydrogen and inactive gas, in preparation for metal deposition, the translation supplies more relevant details. In the translation, teachings of cleaning substrates, inclusive of those with insulating surfaces are found in claims 3-4 (p.2-3); Figures 2 described on p. 9, paragraph 4 (bridging to page 10); page 11 in implementation 3; etc. Plasma cleaning of this insulating surface using a reducing atmosphere of  $\text{H}_2$ , or  $\text{H}_2$  mixed with He or Ar, in order to remove dirt and impurities, including -OH groups, water and absorbed oxygen, prior to deposition of metal on the surface is taught. See claims 1-2 on p.2; Fig. 1; p.3, sec.3-p.4, 2<sup>nd</sup> full paragraph; p.5, lines 5-9; p.6, last paragraph-p.7, 1<sup>st</sup> full paragraph. Note on p. 8, lines 5 + of the translation, it is taught that since the surface is clean, it is physically active to the metal vapor deposition that is performed, and metal including, but not limited to Al or Ti (p.8) are deposited after taught  $\text{H}_2 + \text{He}$  plasma cleaning.

It would have been obvious to one of ordinary skill in the art to employ the active reduction gas  $\text{H}_2$  in the process of Yoo et al, because Yamazaki et al shows that  $\text{H}_2 + \text{He}$  plasma is analogously used to prepare insulating surfaces for metal deposition, where like metal may be deposited (Yoo et al, col.5, 114-23, Ti, TiW, Al), so one of ordinary skill would have expected equivalent results, with the deposition surfaces noted to have been actuated for the metal deposition by the  $\text{H}_2 + \text{He}$  plasma treatment.

Alternately, Yoo et al + Zhao et al was discussed previously (paper #20), but as was noted Zhao et al uses Ar instead of He for its inert gas. While Ar and He are homologous plasma gases due to their

Art Unit: 1762

both being noble gases, Zhao et al does not explicitly show the use of He with H<sub>2</sub> in plasma cleaning or preparing patterned insulating surfaces analogous to those of Yoo et al, however Yamazaki et al explicitly shows the equivalence of using Ar or He with H<sub>2</sub> for reduction plasma cleaning of analogous insulating surfaces, hence providing further motivation for the obviousness of using that combination alternatively to CF<sub>3</sub>H + He in Yoo et al, especially as Yoo et al already employs helium in treating the patterned surface.

4. Applicant's arguments with respect to claims 1, 3-4, 6, 8-14, 17-23 and 33 are have been considered but are moot in view of the new ground(s) of rejection.

Applicant's arguments filed 7/7/03 have been fully considered but they are not persuasive.

Use of alternative gases known and shown to have analogous and equivalent effects in analogous situations provide motivations for one of ordinary skill in the art to substitute those gases or materials, since the prior art has demonstrated the effectiveness of the alternative. Zhao et al shows Ar + H<sub>2</sub> effective in the use of cleaning substrates with via holes, i.e. patterned. Note this process is intended to be used to clean up after previous etching steps (Col.3, lines 2-16), because undesired materials left after such previous steps are known to cause problems. This is consistent with Yoo et al's process, as the Ar-plasma treatment step that precedes their CF<sub>3</sub>H (or CF<sub>4</sub>) + He plasma, reads on such. Also note, while Col.5, lines 3-13 discuss the "soft reactive ion etch" (CF<sub>4</sub>/He) as effecting reduced contact resistance, this is consistence with Yamazaki et al's effect of removing impurities that will effect the deposit, its adherence, and its purity, hence resistance; as well as consistence with Zhao et al's teaching that removal of undesired materials, such as oxides that may inhibitor or prevent a desired electrical connection on a substrate (Col.3, lines 7-10). For these reasons, substitution of H<sub>2</sub> for the CF<sub>3</sub>H or CF<sub>4</sub> reducing gas of Yoo et al, would have been obvious and motivated.

Art Unit: 1762


5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

6. Any inquiry concerning this communication should be directed to M L. Padgett at telephone number (703) 308-2336 (or (571) 272-1425 after mid Dec.) on M-F from about 8:30 am - 4:30 pm, and FAX# (703) 872-9306 (official).

Padgett/lap 10/21/03

October 15, 2003



MARIANNE PADGETT  
PRIMARY EXAMINER